ATTORNEY'S DOCKET 10/060,983
1017_P064US

IN THE CLAIMS:

(Amended) 1. A system for testing a physical attribute of a manufactured object, the system comprising:

a laser ultrasound generation system to generate an ultrasonic signal within with the manufactured object with at least one laser pulse;

a two wave mixing interferometer measures the ultrasonic signal, using:

of coherent electromagnetic energy; and

a pump beam of coherent electromagnetic energy, wherein the probe beam of coherent electromagnetic energy scans across the manufactured object.; , wherein scanning the probe beam alters a wave characteristic of the probe beam, and is scattered or reflected by the manufactured object;

at least one wave characteristic adjusting device coupled to the two-wave mixing interferometer, wherein the

the at least one wave characteristic adjusting device adjusts a wave characteristic of at least one beam of coherent electromagnetic energy to compensate for distortion ; caused by scanning the probe beam of the two-wave mixing interferometer.

2. The system of Claim 1 wherein the at least one wave characteristic adjusting device is situated in the optical path of the pump beam.

3. The system of Claim 1 wherein the at least one wave characteristic adjusting device is situated in the optical path of the probe beam.

4. The system of Claim 1, the system further comprising:

a wave characteristic controlling system, the wave characteristic controlling system operable to direct the at least one wave characteristic adjusting device.

(Amended) 5. A system for measuring a physical attribute of a manufactured object, the system comprising:

a sonic energy signal generator;

the sonic energy signal generator initiating at least one sonic energy signal associated with the manufactured object;

a two-wave mixing interferometer;

the two-wave mixing interferometer having a pump beam of coherent electromagnetic energy and a probe beam of coherent electromagnetic energy, the probe beam of coherent electromagnetic energy being scanned across the manufactured object, the probe beam reflecting from the object with an altered wave characteristic caused by the scanning motion of the probe beam; and

at least one wave characteristic adjusting device coupled to the two-wave mixing interferometer to adjust a wave characteristic of at least one beam of coherent electromagnetic energy in order to compensate ;

for the altered wave characteristic caused by scanning the probe beam .

6. The system of Claim 5 wherein the at least one wave characteristic adjusting device is situated in the optical path of the probe beam of coherent electromagnetic energy.

7. The system of Claim 5 wherein the at least one wave characteristic adjusting device is situated in the optical path of the pump beam of coherent electromagnetic energy.

8. The system of Claim 5, the system further comprising:

a wave characteristic controlling system, the wave characteristic controlling system operable to direct the at least one wave characteristic adjusting device.

9. The two-wave mixing interferometer of Claim 8 wherein the first beam is a pump beam of the two-wave mixing interferometer and the second beam is the probe beam of the two-wave mixing interferometer.

(Amended) 10. A two-wave mixing interferometer for detecting a sonic energy signal about a manufactured object, the two-wave mixing interferometer scanning a probe beam across a surface of the manufactured object, the two-wave mixing interferometer comprising:

at least one coherent electromagnetic energy generator, the at least one coherent electromagnetic energy generator generating at least one beam of coherent electromagnetic energy;

at least one wave characteristic controlling circuitry, the at least one wave characteristic controlling circuitry communicatively coupled to the at least one coherent electromagnetic energy generator, wherein the

the at least one wave characteristic controlling circuitry adjusts a wave characteristic of the at least one beam of coherent electromagnetic energy to compensate for the wave characteristic distortion caused by scanning the probe beam .

11. The two-wave mixing interferometer of Claim 10 wherein the at least one beam of coherent electromagnetic energy is the probe beam of the two-wave mixing interferometer.

12. The two-wave mixing interferometer of Claim 10 wherein the at least one beam of coherent electromagnetic energy is a pump beam of the two-wave mixing interferometer.

13. The two-wave mixing interferometer of Claim 10, the two-wave mixing interferometer further comprising:

a wave characteristic controlling system communicatively coupled to the wave characteristic controlling circuitry; and

the wave characteristic controlling system operable to direct the wave characteristic controlling circuitry.

(Amended) 14. A wave characteristic adjusting device for adjusting a wave characteristic of a beam of coherent electromagnetic energy distorted by scanning the beam of coherent electromagnetic energy, wherein the beam of coherent electromagnetic energy being of a two-wave mixing interferometer, the frequency shifting device comprising:

an electro-optic polarizer situated in a path of the beam of coherent electromagnetic energy;

a polarized beam deflector situated in the path of the beam of coherent electromagnetic energy;

a first electro-optic phase modulator;

a second electro-optic phase modulator;

the beam of coherent electro-magnetic energy selectively passing through the polarized beam deflector to the first electro-optic phase modulator if the electro-optic polarizer has a first specific operating characteristic;

the electro-optic phase modulator continuously altering a wave characteristic of the beam of coherent electromagnetic energy;

the beam of coherent electromagnetic energy selectively deflecting from the polarized beam deflector to the second electro-optic phase modulator if the electro-optic polarizer has a second specific operating characteristic;

the second electro-optic phase modulator continuously altering the wave characteristic of the beam of coherent electromagnetic energy;

the electro-optic polarizer operable to switch modes; and

the wave characteristic of the beam of coherent electromagnetic energy being altered to compensate for a wave characteristic distortion caused by a scanning motion of a probe beam of the two-wave mixing interferometer.

15. The wave characteristic adjusting device of Claim 14 wherein the beam of coherent electromagnetic energy is the probe beam of the two-wave mixing interferometer.

16. The wave characteristic adjusting device of Claim 14 wherein the beam of coherent electromagnetic energy is a pump beam of the two-wave mixing interferometer.

17. A wave characteristic adjusting device for adjusting a wave characteristic of a beam of coherent electromagnetic energy, distorted by scanning the beam of coherent electromagnetic energy, wherein the beam of coherent electromagnetic energy being of a two-wave mixing interferometer, the wave characteristic adjusting device comprising:

at least one electro-optic phase modulator;

the at least one electro-optic phase modulator situated in a path of the beam of coherent electromagnetic energy; and

the at least on electro-optic phase modulator operable to adjust a wave characteristic of the beam of coherent electromagnetic energy by a specific amount in a specific direction, the wave characteristic adjustable to compensate for a wave characteristic distortion caused by a scanning motion of a probe beam of the two-wave mixing interferometer.

18. The wave characteristic adjusting device of Claim 17 wherein the beam of coherent electromagnetic energy is the probe beam of the two-wave mixing interferometer.

19. The wave characteristic adjusting device of Claim 17 wherein the beam of coherent electromagnetic energy is a pump beam of the two-wave mixing interferometer.

20. A frequency shifting device for adjusting a wave characteristic of a beam of coherent electromagnetic energy, distorted by scanning the beam of coherent electromagnetic energy, wherein the beam of coherent electromagnetic energy being of a two-wave mixing interferometer, the wave characteristic adjusting device comprising:

a plurality of electro-optic phase modulators;

the plurality of electro-optic phase modulators situated such that the beam of coherent electromagnetic energy may selectively pass through at least one of the plurality of electro-optic phase modulators; and

the plurality of electro-optic phase modulators operable to adjust the wave characteristic of the beam of coherent electromagnetic energy by amounts and in directions selectively determined, the wave characteristic of the beam of coherent electromagnetic energy being adjusted to compensate for a wave characteristic distortion caused by a scanning motion of a probe beam of the two-wave mixing interferometer.

21. The frequency shifting device of Claim 20 wherein the beam of coherent electromagnetic energy is a probe beam of coherent electromagnetic energy of the two-wave mixing interferometer.

22. The frequency shifting device of Claim 20 wherein the beam of coherent electromagnetic energy is a pump beam of coherent electromagnetic energy of the two-wave mixing interferometer.

(Amended) 23. A system for detecting a sonic energy signal associated with a manufactured object, the system comprising:

a probe beam of coherent electromagnetic energy;

a pump beam of coherent electromagnetic energy;

the probe beam being scanned across a surface of the manufactured object, wherein the probe beam is distorted by scanning;

the probe beam reflecting from the manufactured object with an altered wave characteristic indicative of a scanning motion of the probe beam;

the probe beam being directed to a two-wave mixing interferometer;

either one of the probe beam or the pump beam of coherent electromagnetic energy passing through a wave characteristic adjusting device, the wave characteristic adjusting device communicatively coupled to a wave characteristic controlling system;

the wave characteristic adjusting device operable to adjust a wave characteristic of the either one of the probe beam or pump beam, in order to compensate for distortion caused by scanning the probe beam;

the either one of the probe beam or the pump beam being directed to the two-wave mixing interferometer; and

the wave characteristic controlling system operable to direct the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam.

24. The system of Claim 23, the system further comprising:

the two-wave mixing interferometer communicatively coupled to the wave characteristic controlling system, the two-wave mixing interferometer passing data to the wave characteristic controlling system; and

the wave characteristic controlling system directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy using the data from the two-wave mixing interferometer.

25. The system of Claim 23, the system further comprising:

the two-wave mixing interferometer communicatively coupled to the wave characteristic controlling system; and

the wave characteristic controlling system operable to adjust a parameter of the two-wave mixing interferometer.

26. The system of Claim 23, the system further comprising:

a synthetic signal generator;

the synthetic signal generator situated in a path of the probe beam of coherent electromagnetic energy; and

the synthetic signal generator adding a synthetic coherent electromagnetic energy signal to the probe beam of coherent electromagnetic energy.

27. The system of Claim 26 wherein the wave characteristic controlling system directs the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy using information about the synthetic signal generator.

28. The system of Claim 23, the system further comprising:

the synthetic signal generator communicatively coupled to the wave characteristic controlling system; and

the wave characteristic controlling system operable to direct the synthetic signal generator to add the synthetic coherent electromagnetic energy signal to the probe beam of coherent electromagnetic energy.

29. The system of Claim 23, the system further comprising:

a database having information;

the database communicatively coupled to the wave characteristic controlling system; and

the wave characteristic controlling system operable to direct the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy using the information from the database.

(Amended) 30. The system of Claim 29 wherein the information in the database is information about the manufactured object.

(Amended) 31. The system of Claim 29 wherein the information in the database is information obtained from a previous detection.

32. The system of Claim 23, the system further comprising:

a representation of the manufactured object; and

the wave characteristic controlling system operable to direct the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy using the representation of the manufactured object.

33. The system of Claim 32 wherein the representation of the manufactured object is a computer-aided-drafting representation of the manufactured object.

34. The system of Claim 23, the system further comprising:

a shape measuring device;

the shape measuring device communicatively coupled to the wave characteristic controlling system;

the shape measuring device operable to measure the shape of the manufactured object; and

the wave characteristic controlling system operable to direct the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy using an information from the shape measuring device.

(Amended) 35. A wave characteristic controlling system operable to direct at least one wave characteristic adjusting device to adjust a wave characteristic in at least one beam of coherent electromagnetic energy, in order to compensate for distorting a wave characteristic distorted by scanning the at least one beam of coherent electromagnetic energy, wherein the at least one beam of coherent electromagnetic energy being used in a two-wave mixing interferometer operable to detect at least one sonic energy signal in a manufactured object, the frequency controlling system comprising:

at least one processor;

at least one wave characteristic controlling circuitry communicatively coupled to the processor;

the as at least one processor determining a desired wave characteristic of the at least one beam of coherent electromagnetic energy; and

the at least one wave characteristic controlling circuitry operable to direct the at least one frequency shifting device.

36. The wave characteristic controlling system of Claim 35, the wave characteristic controlling system further comprising:

a programmable circuitry communicatively coupled to the processor; and

the processor determining the desired wave characteristic using the programmable circuitry.

37. The wave characteristic controlling system of Claim 35, the wave characteristic controlling system further comprising:

a readable memory device communicatively coupled to the processor.

38. The wave characteristic controlling system of Claim 37, the wave characteristic controlling system further comprising:

a database stored on the readable memory device; and

the processor determining the desired wave characteristic from the database stored on the readable memory device.

39. The wave characteristic controlling system of Claim 37, the wave characteristic controlling system further comprising:

a representation of the manufactured object stored on the readable memory device; and

the processor determining the desired wave characteristic from the representation of the manufactured object stored on the readable memory device.

(Amended) 40. A method for testing a physical attribute of a manufactured object, the method comprising:

generating an ultrasonic signal associated with the manufactured object with at least one laser pulse;

measuring the ultrasonic signal with a two wave mixing interferometer, the two-wave mixing interferometer having a probe beam of coherent electromagnetic energy and a pump beam of coherent electromagnetic energy;

scanning the probe beam of coherent electromagnetic energy across the manufactured object, wherein scanning wave characteristic of the probe beam; and

adjusting a wave characteristic of at least one beam of coherent electromagnetic energy with at least one wave characteristic adjusting device to compensate for the altered wave characteristic caused by scanning the probe beam .

41. The method of Claim 40 wherein the at least one wave characteristic adjusting device is situated in the optical path of the pump beam.

42. The method of Claim 40 wherein the at least one wave characteristic adjusting device is situated in the optical path of the probe beam.

43. The method of Claim 40, the method further comprising:

directing the at least one wave characteristic adjusting device with a wave characteristic controlling system.

(Amended) 44. A method for measuring a physical attribute of a manufactured object, the method comprising:

initiating at least one sonic energy signal associated with the manufactured object with a sonic energy signal generator;

measuring the sonic energy signal with a two-wave mixing interferometer;

the two-wave mixing interferometer having a pump beam of coherent electromagnetic energy and a probe beam of coherent electromagnetic energy, the probe beam of coherent electromagnetic energy being scanned across the manufactured object, the probe beam reflecting from the object with an altered wave characteristic caused by the scanning motion of the probe beam; and

adjusting a wave characteristic of at least one beam of coherent electromagnetic energy with at least one wave characteristic adjusting device situated in a path of the at least one beam of coherent electromagnetic energy;, wherein adjusting compensates for

the altered wave characteristic caused by scanning the probe beam .

45. The method of Claim 44 wherein the at least one wave characteristic adjusting device is situated in the optical path of the probe beam of coherent electromagnetic energy.

46. The method of Claim 44 wherein the at least one wave characteristic adjusting device is situated in the optical path of the pump beam of coherent electromagnetic energy.

47. The method of Claim 44, the method further comprising:

directing the at least one wave characteristic adjusting device with a wave characteristic controlling system.

(Amended) 48. A method for detecting a sonic energy signal associated with a manufactured object with a two-wave mixing interferometer, the two-wave mixing interferometer

scanning a probe beam across a surface of the manufactured object, the two-wave mixing interferometer comprising:

generating at least one beam of coherent electromagnetic energy with at least one coherent electromagnetic energy generator; and

adjusting a wave characteristic of the at least one beam of coherent electromagnetic energy to compensate for the wave characteristic distortion caused by scanning the probe beam, wherein adjusting the wave characteristic is achieved by controlling the at least one coherent electromagnetic energy generator with at least one wave characteristic controlling circuitry

49. The method of Claim 48 wherein the at least one beam of coherent electromagnetic energy is the probe beam of the two-wave mixing interferometer.

50. The method of Claim 48 wherein the at least one beam of coherent electromagnetic energy is pump beam of the two-wave mixing interferometer.

51. The method of Claim 48, the method further comprising:

directing the wave characteristic controlling circuitry with a wave characteristic controlling system communicatively coupled to the wave characteristic controlling circuitry.

(Amended) 52. A method for adjusting a wave characteristic of a beam of coherent electromagnetic energy with a wave characteristic adjusting device, in order to compensate for wave distortion caused by scanning a probe beam, wherein the beam of coherent electromagnetic energy being of a two-wave mixing interferometer, the method comprising:

selectively passing the beam of coherent electro-magnetic energy through a polarized beam deflector situated in a path of the beam of coherent electromagnetic energy to a first electro-optic phase modulator if an electro-optic polarizer situated in the path of the beam of coherent electromagnetic energy has a first specific operating characteristic;

continuously altering a wave characteristic of the beam of coherent electromagnetic energy with the electro-optic phase modulator;

selectively deflecting the beam of coherent electromagnetic energy from the polarized beam deflector to the second electro-optic phase modulator if the electro-optic polarizer has a second specific operating characteristic;

continuously altering the wave characteristic of the beam of coherent electromagnetic energy with the second electro-optic phase modulator;

the electro-optic polarizer operable to switch modes; and

the wave characteristic of the beam of coherent electromagnetic energy being altered to compensate for a wave characteristic distortion caused by a scanning motion of a probe beam of the two-wave mixing interferometer.

53. The method of Claim 52 wherein the beam of coherent electromagnetic energy is the probe beam of the two-wave mixing interferometer.

54. The method of Claim 52 wherein the beam of coherent electromagnetic energy is a pump beam of the two-wave mixing interferometer.

(Amended) 55. A method for adjusting a wave characteristic of a beam of coherent electromagnetic energy with a wave characteristic adjusting device, , in order to compensate for wave distortion caused by scanning a probe beam, wherein the beam of coherent electromagnetic energy being of a two-wave mixing interferometer, the method comprising:

adjust a wave characteristic of the beam of coherent electromagnetic energy by a specific amount in a specific direction with at least one electro-optic phase modulator situated in a path of the beam of coherent electromagnetic energy, the wave characteristic adjustable to compensate for a wave characteristic distortion caused by a scanning motion of the probe beam of the two-wave mixing interferometer.

56. The method of Claim 55 wherein the beam of coherent electromagnetic energy is the probe beam of the two-wave mixing interferometer.

57. The method of Claim 55 wherein the beam of coherent electromagnetic energy is a pump beam of the two-wave mixing interferometer.

(Amended) 58. A method for adjusting a wave characteristic of a beam of coherent electromagnetic energy with a wave characteristic adjusting device, in order to compensate for wave distortion caused by scanning a probe beam, wherein the beam of coherent electromagnetic energy being of a two-wave mixing interferometer, the method comprising:

selectively passing the beam of coherent electromagnetic energy through at least one of a plurality of electro-optic phase modulators; and

adjusting the wave characteristic of the beam of coherent electromagnetic energy by amounts and in directions selectively determined, the adjusting being performed by the at least one of the plurality of electro-optic phase modulators, the wave characteristic of the beam of coherent electromagnetic energy being adjusted to compensate for a wave characteristic distortion caused by a scanning motion of the probe beam of the two-wave mixing interferometer.

59. The method of Claim 58 wherein the beam of coherent electro-magnetic energy is the probe beam of coherent electromagnetic energy of the two-wave mixing interferometer.

60. The method of Claim 58 wherein the beam of coherent electro-magnetic energy is a pump beam of coherent electromagnetic energy of the two-wave mixing interferometer.

(Amended) 61. A method for detecting a sonic energy signal associated with a manufactured object, the method comprising:

scanning a probe beam of coherent electromagnetic energy across a surface of the manufactured object, wherein scanning distorts a wave characteristic of the probe beam;

the probe beam reflecting from the manufactured object with an altered wave characteristic indicative of a scanning motion of the probe beam;

directing the probe beam to a two-wave mixing interferometer;

passing either one of the probe beam or the pump beam of coherent electromagnetic energy through a wave characteristic adjusting device, the wave characteristic adjusting device communicatively coupled to a wave characteristic controlling system;

adjusting a wave characteristic of the either one of the probe beam or the pump beam with the wave characteristic adjusting device, in order to compensate for the wave distortion caused by scanning the probe beam;

directing the pump beam to the two-wave mixing interferometer; and

directing the wave characteristic adjusting device with the wave characteristic controlling system to adjust the wave characteristic of the either one of the probe beam or the pump beam.

62. The method of Claim 61, the method further comprising:

passing data to the wave characteristic controlling system from the two-wave mixing interferometer; and

directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy with the wave characteristic controlling system using the data from the two-wave mixing interferometer.

63. The method of Claim 61, the method further comprising:

adjusting a parameter of the two-wave mixing interferometer with the wave characteristic controlling system.

64. The method of Claim 61, the method further comprising:

adding a synthetic coherent electromagnetic energy signal to the probe beam of coherent electromagnetic energy with a synthetic signal generator situated in a path of the probe beam of coherent electromagnetic energy.

65. The method of Claim 64 wherein the wave characteristic controlling system directs the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or pump beam of coherent electromagnetic energy using information about the synthetic signal generator.

66. The system of Claim 65, the method further comprising:

directing the synthetic signal generator to add the synthetic coherent electromagnetic energy signal to the probe beam of coherent electromagnetic energy, the directing being performed by the wave characteristic controlling system.

67. The method of Claim 61, the method further comprising:

directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or pump beam of coherent electromagnetic energy with the wave characteristic controlling system, the wave characteristic controlling system using an information from a database.

68. The method of Claim 67 wherein the information in the database is information about the manufactured object.

69. The method of Claim 67 wherein the information in the database is information obtained from a previous detection.

70. The system of Claim 61, the system further comprising:

directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy with the wave characteristic controlling system, the wave characteristic controlling system using a representation of the manufactured object.

71. The method of Claim 70 wherein the representation of the manufactured object is a computer-aided-drafting representation of the manufactured object.

72. The method of Claim 70, the method further comprising:

directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy with the wave characteristic controlling system, the wave characteristic controlling system using data from the two-wave mixing interferometer.

73. The method of Claim 61, the method further comprising:

measuring a shape of the manufactured object with a shape measuring device communicatively coupled to the wave characteristic controlling system; and

directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or the pump beam of coherent electromagnetic energy with the wave characteristic controlling system, the wave characteristic controlling system using an information from the shape measuring device.

74. The method of Claim 73, the method further comprising:

directing the wave characteristic adjusting device to adjust the wave characteristic of the either one of the probe beam or pump beam of coherent electromagnetic energy with the wave characteristic controlling system, the wave characteristic controlling system using the data from the two-wave mixing interferometer.

(Amended) 75. A method to direct at least one wave characteristic adjusting device to adjust a wave characteristic in at least one beam of coherent electromagnetic energy using a wave characteristic controlling system, in order to compensate for a wave distortion caused by scanning the at least one beam of coherent electromagnetic energy, wherein the at least one beam of coherent electromagnetic energy being used in a two-wave mixing interferometer, the two-wave mixing interferometer operable to detect at least one sonic energy signal in a manufactured object, the method comprising:

determining a desired wave characteristic of the at least on beam of coherent electromagnetic energy with at least one processor; and

the operable to directing at least one wave characteristic adjusting device with at least one wave characteristic controlling circuitry communicatively coupled the at least one processor.

76. The method of Claim 75, the method further comprising:

determining the desired wave characteristic with a processor, the processor using a programmable circuitry communicatively coupled to the processor.

77. The method of Claim 75, the method further comprising:

determining the desired wave characteristic with the processor, the processor determining the desired wave characteristic from a database stored on a readable memory device.

78. The method of Claim 75, the method further comprising:

determining the desired wave characteristic with the processor, the processor determining the desired wave characteristic from a representation of the manufactured object stored on a readable memory device.